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SCIENCE EDUCATION RESEARCH STUDIES--1953.

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SUMMARIES OF 46 STUDIES IN SCIENCE EDUCATION COMPLETED DURING 1953 ARE TREATED IN THIS LISTING. THE STORIES LISTED REPRESENT THE RESPONSE TO A NATIONWIDE QUESTIONNAIRE REQUESTING COPIES OF RESEARCH REPORTS. FOR EACH ENTRY IN THE LISTING THERE ARE INCLUDED--(1) THE AUTHOR'S NAME, (2) THE TITLE OF THE STUDY, (3) WHETHER OR NOT IT IS A THESIS OR DEGREE ITEM, (4) THE YEAR THE STUDY WAS COMPLETED, (5) THE INSTITUTION WHERE THE STUDY WAS CONDUCTED, (6) THE NUMBER OF PAGES IN THE COMPLETE REPORT, (7) THE SOURCE FROM WHICH THE COMPLETE STUDY MAY BE OBTAINED, (8) A STATEMENT OF THE PROBLEM, (9) THE SOURCES OF DATA, (10) THE KIND OF STATISTICAL TREATMENT USED, AND (11) THE MAJOR FINDINGS. ENTRIES ARE LISTED ALPHABETICALLY BY THE AUTHOR'S LAST NAME. (RS)

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SCIENCE EDUCATION RESEARCH STUDIES -- 1953

This summary of research studies in science education is the fourth* annual listing which has grown out of a cooperative project involving the National Association for Research in Science Teaching and the Office of Education. Forty-six studies are reported in this summary for 1953.

Report forms and criteria for pertinent research studies were mailed to research leaders throughout the Nation in November 1953. As reports were received the summaries were prepared from the data given. No attempts were made to evaluate the quality of the research studies. The statements in the summaries of research studies were, except in a few instances, as reported by the author. The reports were sent to the Office of Education for the purpose of bringing research studies to the attention of those who seek such information.

Persons who know of related studies which were completed during 1953 but which are not included in this listing are urged to bring them to the attention of the Office of Education. These studies will then be included in the next annual listing.

The information given concerning each study includes, wherever possible, the following items in the order given: author (surname first), title of study, "non-thesis" or degree if a thesis, year study was completed, institution where study was carried out, pages in the complete report, and source from which copy of the complete study may be obtained. This is followed by a statement of the problem or problems, methods used, sources of data, statistical treatment used, and major findings. Full information can be obtained best from the source given in the summary.

Since this is a service project, suggestions concerning ways to make the summaries of increased help will be appreciated.

This summary of research studies for 1953 was prepared through the cooperation of Dr. Kenneth E. Brown and Dr. Paul E. Blackwood of the U.S. Office of Education. Dr. Philip G. Johnson of Cornell University assisted with editorial work in preparation of the summaries.

*Copies of 1950 and 1951 listings may be obtained from the Department of Health, Education, and Welfare, Office of Education, Washington 25, D. C. The 1952 listing appears in Science Education, Vol. 38, No. 1, February 1954.

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ADEGBITE, JOSEPH ADEJUMOBI. Science Education and Developmental Tasks of Nigerian Youth. Ed.D, 1953, Columbia University. 200 pp. Library, Teachers College, Columbia University, New York.

Problem or Problems.--To identify the developmental tasks of Nigerian youth as they seek to prepare themselves for adult life in a changing culture. The tasks identified were analyzed for implications for improvement of education of science teachers for Nigerian secondary schools.

Steps or Methods.--An opinionaire, supplemented by interviews, was employed to gather data concerning developmental tasks of adolescents. The opinionaire, consisting of 68 items, was administered to a sample of 120 boys in the upper four classes of the secondary school of the Baptist Academy, Lagos (Nigeria), by the principal and the staff of the science department. The data obtained from the 116 completed returns were tallied, tabulated, and analyzed by categories for their implications for successful learning (or otherwise) of the developmental tasks indicated. Based upon this analysis, implications for science teaching and for teacher education were drawn, and recommendations made.

Sources of Data.--Opinionaire and interviews.

Statistical Treatment.--Analysis by categories.

Major findings.--The responses to the questions and statements comprising the opinionaire indicated a lack of adequate mastery of developmental tasks, and revealed the need to make the teaching of science functional in order to help adolescents learn these tasks. The only category of developmental tasks learned effectively was that of "acquiring information" on physical phenomena. The other nine categories of developmental tasks identified in the school setting as set up in the study were (1) science interests, (2) hobbies and handicrafts, (3) games and sports, (4) sex education and preparation for marriage, (5) health information, (6) vocation, (7) race and tribal relations, (8) intellectual maturity and value building, and (9) independence from adults.

The study also revealed that secondary schools of Nigeria would be required, at least for some years to come, to deal with developmental tasks of early adulthood.

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ALSTON, FRANK HOWARD. A Study of Science Interests of Pupils in Grades Nine Through Twelve at Hillside High School, Durham, North Carolina. M.A., 1953, North Carolina College. 52 pp. Library, North Carolina College, Durham.

Problem or Problems.--(1) To determine the science subject areas and activities in which boys and girls express high and low interests. (2) To determine: (a) whether or not significant relationships existed among the interests in the three science areas sampled by

the interest index; and (b) whether or not science interests were related to interests in reading and manipulative activities. (3) To determine whether or not the average marks made by students in science were related to their interests in science. (4) To discover the extent to which opportunities were provided in the school for pupils to explore their expressed interests in science.

Steps or Methods.--(1) The results of an interest index administered to 100 students in grades nine through twelve were analyzed for characteristic interests of boys and girls. (2) Central tendency statistics were used to determine the general characteristics of the data and product-moment correlations were run in an effort to uncover important relationships between the several categories of data on interests. (3) The group was divided into upper, middle, and lower thirds on the basis of the average mark in science obtained by pupils and the basis of expressed interests in science. Comparisons of these subgroups were made. (4) A check list of outstanding interests of students was compared with a list of science activities in the school.

Sources of Data.--Interviews, questionnaires, and P.E.A. Interest Index.

Statistical Treatment.--Mean, coefficient of correlation, and comparison of frequencies.

Major Findings.--(1) The strongest interests of boys were in physical science (75.7 percent), biology (72.1 percent), and manipulative activities (61.5 percent). (2) The strongest interests of girls were in biology (67.3 percent), and reading (59.9 percent). (3) The boys as a group exhibited less variability in their dislikes for mathematics than the girls, although the girls as a group disliked a larger number of the mathematics activities than the boys. (4) Correlations between physical science and mathematics interests of boys were high and significant (.94), indicating a strong relationship. For girls, an obtained correlation of .77 suggested a moderate relationship between physical science and manipulative interests of girls. (5) Low and negligible correlations were obtained for mathematics and manipulative activities of girls (.18). (6) The girls exhibited a greater tendency than the boys toward verbalistic activities; but the boys, more than the girls, exhibited a tendency toward manipulative activities. (7) Obtained correlations between biology and physical science, .70 for girls and .54 for boys suggested a moderate relationship between these two groups of activities. (8) There was apparently little or no relationship between the interests of the students and their average achievement marks in science.

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ARN, ELMER HOWARD ROBERT. The Prediction of Academic Success in Ten Selected Science Areas at the University of Washington. Ed.D., 1953, University of Washington. 217 pp. Library, University of Washington, Seattle.

Problem or Problems.--(1) Whether the addition of three reading test variables to the eight predictor variables employed by Angell et al. improves the prediction of first-year academic success in ten selected science areas at the University of Washington. (2) Whether the elaborate and time-consuming methods commonly employed in multi-variable prediction studies can be shortened without loss in accuracy. (3) Which of three regression equations derived by the shorter method of calculation gives the most accurate prediction in the ten selected areas? (4) How accurately can first-year university grades in the ten selected areas be predicted with the eleven predictor variables employed?

Steps or Methods.--Composite Data Sheet, Control Sheet, I.B.M. Procedure, Correlation Work Sheet, Basic Intercorrelation Matrix, Application of the Multiple Regression Method, the Three Regression Equations, and verification and comparison of the Regression Equations.

Sources of Data.--Control groups and other statistical studies.

Statistical Treatment.--Analysis of variance and covariance.

Major Findings.--(1) The Multiple Regression Method promises to make multi-variable prediction studies practical without a loss in accuracy, and addition of more predictor variables is no longer prohibitive. (2) Use of a basic matrix in study similar to one discussed is justified. (3) No single item of information on freshmen students affords an adequate index of ability to do efficient college work. (4) The application of the differential prediction of academic success in different university subject areas promises a better academic adjustment of students and reduction of university failures. (5) The addition of 3 reading test variables from reading section of the Cooperative English Test to the 8 predictors employed in the 2-year study of the 1947 group did not appear to improve the 1950 prediction of first-year academic success in the ten selected science areas by an appreciable amount. (6) The true contribution of reading cannot be evaluated in terms of the difference between R_c (1...11) and R_c (1...8), for reading is incorporated in the other 8 variables employed. (7) The maximum multiple correlation coefficient is statistically possible. In terms of the reliability of the variables involved, it has been reached in a number of the ten science areas selected. If all students always worked up to capacity; if there were some way of knowing how much time, energy, and intelligent application each student devoted to his studies, and if instructors used more objective methods of appraising student achievement, still further reduction in the errors of prediction appears possible. (8) In the determination of the regression equations for the selected areas the accuracy of the predictions was not affected when the independent variable sigmas and means of the "all university group," rather than those of the criterion group, were used. (9) In all the selected science areas where more than 100 cases were available the accuracy of the predictions, in terms of the differences between the actually achieved and predicted grades, was well within

the limits of the calculated standard errors of estimate. (10) The 1950 regression equation, derived to predict average university grades in chemistry, engineering, geology, home economics, physics, and zoology should, within the limits claimed, prove applicable to future freshman groups at the University of Washington. Until the 1950 regression equations in biology, botany, forestry, and pharmacy are revised by the addition of more cases from subsequent freshman groups, future predictions within the 1950 standard errors of prediction may be expected. (11) As the validity of the variables involved in the 1950 study may be expected to undergo changes, a periodic evaluation of future predictions made with the 1950 regression equations will be essential.

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BALCZIAK, LOUIS WILLIAM. The Role of the Laboratory and Demonstration in College Physical Science in Achieving the Objectives of General Education. Ph.D., 1953, University of Minnesota. 176 pp. Library, University of Minnesota, Minneapolis.

Problem or Problems.--To determine the relative effectiveness of the demonstration, the combined demonstration and the individual, and the individual methods of conducting laboratory work in a course in physical science designed for general education purposes.

Steps or Methods.--The method was that of a controlled modern experiment making use of a 2 x 3 randomized block design and the techniques of the analysis of variance and covariance. The experiment continued throughout the academic year and involved 144 students arranged at random into 6 sections. Three outcomes were measured: science information, scientific attitudes, and laboratory performance.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Analysis of variance and covariance.

Major Findings.--Significant gains were made under each of the three methods in science information and in laboratory performance. Only under the individual method was there a significant gain in scientific attitude. There was a significant increase in variability on the laboratory performance test in one section of each of the three methods. There was no significant difference in means among the several methods in the three outcomes measured.

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BARNETT, SUE MALONE. A Study of Our Marine Environment as a Florida Resource to be Used in the Elementary Science Program. M.S., 1953, Florida State University. 95 pp. (copy of study not available).

Problem or Problems.--To determine the possibilities of using the marine environment in enriching the elementary science program.

Steps or Methods.--(1) A course in marine biology. (2) Many field trips to coast. (3) Stocking and maintaining aquaria. (4) Experience with elementary children.

Sources of Data.--Field work, reference books, and periodicals.

Statistical Treatment.--None.

Major Findings.--(1) Extensive knowledge in biology and ecology is not necessary for profitable utilization of marine materials in the elementary science program. (2) A study of marine life will enrich the science program in the elementary school.

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CALDWELL, LOREN THOMAS. A Determination of the Earth Science Principles Desirable for Inclusion in the Science Program of General Education in the Secondary School. Ed.D., 1953, Indiana University. 199 pp. Library, Indiana University, Bloomington.

Problem or Problems.--(1) To derive from an analysis of published materials in the earth sciences those principles which may be used in the science program of general education in the secondary school. (2) To determine the relative importance of earth science principles which are desirable for inclusion in the science program of general education in the secondary school.

Steps or Methods.--This investigation consisted of three phases. (1) The compilation of source materials in the earth sciences. (2) An analysis of selected earth science sources for statements of tentative earth science principles. (3) The determination of the relative importance of earth science principles which are desirable for inclusion in the science program of general education in the secondary school. The relative importance of the earth science principles was determined by five science educators who have furnished outstanding leadership in the teaching of science.

Sources of Data.--Reference books, periodicals, and textbooks.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--In all, 332 principles of the earth sciences were derived from an analysis of all sources of materials in this investigation. On the basis of the independent ratings by a jury of evaluators, 296 of these 332 principles were judged to be desirable for inclusion in the science program of general education in the secondary school. Of these 296 desirable earth science principles, 191 earth science principles were judged as highly desirable and 105 were judged as desirable. There were 123 which related primarily to the area of geology, 60 to physical geography (including weather and climate), 60 to the area of astronomy, and 53 to the area of the scientific aspects of conservation.

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CONRAD, HALLIE M. Science Practices Used by Selected Elementary Teachers. M. A., 1953, Ball State Teachers College. 51 pp. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--Who is responsible for teaching elementary science, where and when is it taught, what equipment is available, and what is further needed to improve a science program in the elementary grades?

Steps or Methods.--Data for the study were obtained from seven science supervisors and thirty-five elementary science teachers located in Cleveland, Ohio; Louisville, Kentucky; Fort Wayne, Indiana; Richmond, Indiana; and New Castle, Indiana. Elementary teachers were interviewed and observed in their classrooms, and each submitted information relative to their science practices on a questionnaire constructed by the investigator. This information was tabulated showing practices of selected elementary science teachers in rank order of importance.

Sources of Data.--Interviews and observations of teachers.

Statistical Treatment.--Mean, comparison of frequencies, and rank order.

Major Findings.--(1) Homeroom teachers were responsible for nearly all of the science taught in kindergarten through the sixth grade. (2) A definite science period each week was characteristic of more than one-half of the teachers interviewed. (3) Movable tables and chairs in the classrooms made group work much easier. (4) More than one half of the science equipment was stored in storage rooms. (5) Science books and magazines were used extensively in all schools observed. (6) Five science units ranked in order of importance to 35 elementary science teachers were: plants, weather, health and safety, animals, and air. (7) The farm, a walk, the dairy, parks, and the airport were considered the most important places for field trips. (8) More time to plan, more time to teach science, more trained teachers in elementary science, and more integration of science work were outstanding suggestions for needed science improvement. There is definite science work being done in selected schools where the curriculum had been judged successfully for many years.

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COOK, ROBERT E. A Suggested Science Room Design for Nebraska Schools. M.A., 1953, University of Nebraska. 109 pp. Library, University of Nebraska, Lincoln.

Problem or Problems.--To develop a design for an adequate science classroom in which general science, biology, physics, chemistry, or other high school science offering may be satisfactorily taught.

Steps or Methods.--The author used selected school visitation, conference, correspondence, and other techniques to accumulate basic data on science room design.

Erase pencil instructions before proofing (read to here pg 8 & 14 which were missed.)

Sources of Data.--Interviews, reference books, periodicals, visitation to see facilities, and worksheets.

Statistical Treatment.--Mean and median.

Major Findings.--A room design for general science, biology, physics and chemistry classes with adjoining storerooms was proposed.

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DeLOACH, WILL S. General Chemistry Textbook Prices, 1925-51. Non-thesis, 1953, Arkansas State Teachers College. 2 pp. Author, Arkansas State Teachers College, Conway.

Problem or Problems.--Investigation of the "real cost" of college general chemistry textbooks published 1925-51. Prices of the books were adjusted to allow for variation in purchasing price of the dollar.

Steps or Methods.-- A survey of prices of textbooks from the literature from 1925-51.

Sources of Data.--Reference books and periodicals.

Statistical Treatment.--None.

Major Findings.--"Real cost" of college general chemistry textbooks rose during depression years, then declined, and in 1951 was at its lowest (except for one year).

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DIETRICH, MARY ALICE. A Suggested Course of Study for Introductory College Biology, with an Emphasis on the Study of Living Material. Ph.D., 1953, Cornell University. 173 pp. Library, Cornell University, Ithaca, New York.

Problem or Problems.--To provide specific suggestions for a course in introductory college biology, which is concerned with the study of living materials. The apparent need for such suggestions came to the author's attention after several years of experience of teaching in several institutions.

Steps or Methods.--Consultation of literature including biology textbooks and laboratory manuals, current periodical literature, and theses.

Sources of Data.--Reference books, periodicals, and textbooks.

Statistical Treatment.--None.

Major Findings.--The course outlined in this thesis could be adapted to local situations and would give an instructor help in including living materials in courses in biology and in overcoming the obstacles of limited time and space.

DUBINS, MORTIMER IRA. Current Practices in Elementary School Science with Reference to Courses of Study Published from 1940 to 1952, and the Extent of Activities Undertaken for the Improvement of Instruction. Ed.D., 1953, Boston University. 543 pp. Library, Boston University, Boston, Massachusetts.

Problem or Problems.--(1) To determine the content of several courses of study in elementary school science published since 1940. (2) To determine what was being done for the improvement of elementary science instruction. (3) To make available a source of information concerning the present practices in instruction in science in the elementary schools of the United States.

Steps or Methods.--(1) List of courses of study in elementary science published from 1940-1952 was compiled. (2) Courses of study were obtained. (3) Courses of study were subjected to a topical analysis involving five major areas of the environment divided into 34 subareas which in turn were divided into topics. (4) Science principles suitable for instruction in the elementary school were sought and their frequency of occurrence recorded. (5) Objectives were analyzed and activities for pupils and materials for instruction were tabulated. (6) Transmittal of inquiry forms to a stratified random sample involving State Departments of Education, science educators and members of a direct request sample. (7) Analysis of returned inquiry forms.

Sources of Data.--Courses of study and questionnaires.

Statistical Treatment.--Coefficient of correlation.

Major Findings.--(1) A topical subject matter content guide was developed as an encyclopedia of topics logically presented, and at the same time a report of present practice. (2) Less than 4 percent of the 476 major topics reoccurred in over half of the 163 grade-courses of study. Slightly less than one sixth of the major topics reoccurred in from 25 to 49 percent of the grade-courses of study. (3) The more than 450 topics present in the courses of study in elementary science reveal confusion in what subject matter to teach. (4) Evidence of grade placement of several major topics was discovered. (5) Doubt and confusion exists as to what principles should be taught in the elementary school. (6) Larger cities are more likely to publish a course of study in elementary science, to employ consultants in making a course of study and to hold science conferences and workshops for the elementary school teacher. (7) Most of the states have colleges which are presenting workshops in science for the elementary teacher. (8) Fewer than 10 percent of the states have agencies which publish pamphlets in science for the elementary school teacher.

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ELLIOTT, JAMES McFARLAND. An Evaluation of Certain Courses in Relation to Understanding of Principles in a Biological Science Course. Ed.D., 1953, Michigan State College. 443 pp. Library, Michigan State College, East Lansing.

Problem or Problems.--(1) To obtain from the staff of the Department of Biological Science an evaluation of the content of the "Biological Science Lecture Syllabus" relative to an understanding of the principles presented in the course and (2) to derive from these data certain inferences and generalizations having implications for (a) the objectives of biological science, (b) the "minimum essentials" concept as it relates to biological science, (c) the revision of the "Biological Science Lecture Syllabus" and the "Study Guide for Biological Science," (d) the examination program in biological science, and (e) the preparation of laboratory studies for biological science.

Steps or Methods.--(1) Construction of the rating instrument. (2) Administration of the instrument. (3) Analysis of evaluations obtained by means of the instrument. (4) Determination of reliability of the rating instrument. (5) Formulation of conclusions and educational implications.

Sources of Data.--Expert judgments and questionnaires.

Statistical Treatment.--Coefficient of correlation.

Major Findings.--It was possible to conclude that, in the opinion of the teaching staff, the "Biological Science Lecture Syllabus" contains facts which contribute in varying degree toward an understanding of principles presented in the course. Furthermore, the staff of the Department of Biological Science, acting collectively, was able to identify the factual elements of the course in the order of the importance of contribution toward an understanding of principles.

This study indicated that the lecture syllabus does not treat adequately, by comparison, all of the principles presented in the study guide. This study not only indicates areas where revision is particularly needed, but that it also provides information concerning the general nature of the change.

The content of the lecture syllabus does not adequately contribute toward the attainment of the course objective "to acquire knowledge of some of the basic laws (principles) of biology" if it is assumed that this contribution must take the form of an adequate contribution by the syllabus content toward and understanding of the principles presented in the study guide.

Data support the contention that by means of a detailed analysis of a course of study it is possible to marshall the factual elements of course content into orderly support of the major concepts and principles upon which the course is based.

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FISHER, CARL M. A Plan to Improve Science Education in the Mainland High School, Daytona Beach, Florida. M.S. 1953. Florida State University. 43 pp. Library, Florida State University, Tallahassee.

No review provided.

FRANKS, CLEVELAND JAMES. The Organization, Installation, Implementation, and Administration of a Course in Physical Science Designed for General Education at the Morgan State College. Ed.D. 1953, Columbia University. 212 pp. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--(1) What are the types of situations, problems and interests most likely to challenge the individual in the course of his living in a democratic society, and how are these related to our institutions and ways of living? (2) What kinds of abilities and traits do we seek to develop in our students as we help them to prepare for effective participation in our society?

Steps or Methods.--A two-year experimental science program was developed from student's real problems and interests. This course was offered to four classes for two years and compared with the traditional physical science survey course which was offered simultaneously to four classes. Both courses were evaluated and conclusions were based on the findings.

Sources of Data.--Experimental groups.

Statistical Treatment.--None.

Major Findings.--For most non-science majors, a different kind of course is needed from the specialized courses provided in the various science departments. The "block-and-gap" approach is better than the superficial survey or diluted orthodox science course. Student suggestions and criticisms can be of value in locating weaknesses in a program designed for general education science. The general education science program should be flexible enough to allow the teacher to capitalize on the special interests and capacities of the pupils.

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GLIDDEN, HARLEY F. The Identification and Evaluation of Principles of Soil and Water Conservation for Inclusion in the Secondary School Curriculum. Ph.D., 1953, University of Nebraska. 241 pp. Library, University of Nebraska, Lincoln.

Problem or Problems.-- (1) What principles within the area of soil and water conservation should be developed at the secondary school level? (2) How well are these principles being learned from active participation in American life, as from school, club work, reading, listening to radio, etc? (3) Do modifications of the secondary school curriculum in the areas of soil and water conservation seem desirable?

Steps or Methods.--(1) Acquiring from specialists and recognized practicing conservationists in the area of soil and water conservation lists of available bulletins, monographs, pamphlets, and other printed material which these persons designated as containing subject matter and materials valuable for inclusion in the secondary

school curriculum. (2) Analysis of these materials to determine the principles contained or developed in the recommended material. (3) Submission of the resulting list of principles to additional specialists to check for accuracy of subject matter, for clarity of statement, for omissions, duplications, and pertinent additions. (4) Submission of the refined list of principles to two different groups of specialists in education, science educators and secondary school curriculum for evaluation of adaptability and importance for the secondary school curriculum. (5) Statistical analysis of the evaluations of the principles. (6) Elimination of undesirable principles on the basis of statistical data. (7) Preparation of a test intended to measure knowledge and understanding of the more important and adaptable principles. (8) Establishment of the validity and reliability and internal consistency of this test. (9) Revision of the test to secure a valid and reliable test instrument. (10) Administration of the revised test to first quarter freshmen to determine the internal consistency and reliability of the final form of the test. (11) Administration of the test to seniors in selected secondary schools. (12) Analysis of test results to determine whether or not the principles considered to be important are now adequately taught in the existing secondary school curriculum or are being vicariously learned through participation in American life.

Sources of Data.--Experimental groups, control groups, expert judgments, questionnaires, pamphlets, and bulletins.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, critical ratio; Fisher's "t," comparison of frequencies, analysis of variance and covariance, point biserial coefficient of correlation, and a special rating technique.

Major Findings.--This study has contributed (1) A list of twenty-nine bulletins, monographs, pamphlets, and other printed materials which are of value as a part of the knowledge of all citizens. (2) A list of sixty-six basic principles of soil and water conservation which has been approved by both professional conservationists and professional educators. (3) A test intended to measure important facts and understandings in the area of soil and water conservation. (4) Evidence that professional science educators as a group do not differ significantly from other professional educators in their judgment of the importance and appropriateness of principles of soil and water conservation as guides to curriculum construction in secondary schools. (5) No evidence that the size of population center or the geographic region in which a school is located affects the knowledge of soil and water conservation possessed by pupils in that school. (6) Differences in knowledge of soil and water conservation, too large to be attributed to chance, exist between groups of high school pupils enrolled in different schools. (7) The percent of mastery of the principles of soil and water conservation as revealed by the test used in this investigation ranged from 31.06 percent to 56.47 perdent with an average for the thirty-three schools of 44.18 percent.

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HARTSHORNE, JAMES MOTT. An Elementary Course in the Fundamentals of Radio Communications Designed for the Secondary School Level. M.S., 1953, Cornell University. 174 pp. Library, Cornell University, Ithaca, New York.

Problem or Problems.--To develop a course in the fundamentals of radio which would enrich the science program. The course would be designed for high school pupils who had completed a course in physics.

Steps or Methods.--Review of recent secondary school science texts from the standpoint of basic electricity. Development of a course of study including experiments.

Sources of Data.--Reference books, periodicals, and textbooks.

Statistical Treatment.--None

Major Findings.--A course was suggested which could be completed in 18 weeks if the class met for 1½ hours twice a week.

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JACKSON, FERN I. Science Interests of Elementary Children and Activities Devised to Satisfy Their Interests. M.A., 1953, Ball State Teachers College. 81 pp. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--What are children's interests and needs in science and how can one develop an instructional program that would satisfy children's interests?

Steps or Methods.--Fifth-grade children, having had little or no systematic science instruction in previous grades, participated in the study. These children were observed on the playground, in the classroom, and in many out-of-school situations in order to identify their interests in science. Objects which children brought to school were sources of information as to their concerns. Suggestions and comments relating to science were recorded and analyzed by the investigator. After the children's interests were surveyed, an attempt was made to plan science experiences which would help children solve their problems. The children were given an active part in suggesting problems and in planning ways to solve them.

Sources of Data.--Interviews and observations.

Statistical Treatment.--None.

Major Findings.--Of greatest interest to fifth-grade children were "Rocks." Other units were "Turtles," "Magnetism," "Electricity," "Sound and Hearing," "Air," and the "Earth's Surface."

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JENSEN, JENS TRYGUE. Nuclear Energy - Basic Principles, Applications, and Implications. Ed.D., 1953, Columbia University. 145 pp.

Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--To develop a resource unit in atomic energy for teachers of physical science.

Steps or Methods.--Through a study of the literature in the field, material was compiled on (a) principles of nuclear energy, (b) possible uses of atomic energy, and (c) implications of these uses.

Sources of Data.--Reference books, periodicals, textbooks, and personal experience.

Statistical Treatment.--None

Major Findings.--Nuclear energy, although not at present economically feasible, may become an important source of power. The use of tracers is becoming increasingly important. The resource unit in atomic energy should enrich the course in physical science.

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JONES, DAVID GORDON. The Use of Rare or Unusual Materials to Incite Interest and Individual Work in High School Biology. Ed.M., 1953, Cornell University. 65 pp. Library, Cornell University, Ithaca, N.Y.

Problem or Problems.--To collect unusual material for use in the motivation of the study of biology.

Steps or Methods.--Survey of the literature.

Sources of Data.--Reference books, periodicals, and textbooks.

Statistical Treatment.--None

Major Findings.--The material collected was interesting to pupils: It seemed to create a further interest in biology. The idea of adventure and individual discovery was stressed in the material.

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KAIKOW, JULIUS. The Legal and Administrative Status of Conservation Education in the United States. Ph.D., 1953, Columbia University. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--To determine the extent to which conservation education has been given official as well as unofficial recognition and to determine the type of material taught as conservation in this country.

Steps or Methods.--(1) Questionnaires. (2) Interviews. (3) Study of courses of study. (4) Periodical reports. (5) Other printed sources. (6) Personal observations. (7) Publications of interested organizations.

Sources of Data.--Questionnaires, courses of study, interviews, reference books, periodicals, expert judgments, and personal observation.

Statistical Treatment.--None.

Major Findings.--Eleven States have mandatory legislation on conservation education. Not all follow the letter of the law. Twenty-five States plus the District of Columbia have an official administrative policy on conservation education. Of the rest, three are in the process of transition to a definite policy status. In a few States the conservation authorities carry the burden of conservation education. In only a relatively few States is total conservation taught. Emphasis is only on a few resources, usually organic or renewable in character. Exhaustible resources are largely ignored.

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LORBEER, GEORGE COLE. A Determination of Certain Changes in Parental Understandings, Attitudes, and Interests as Compared with Those of Their High School Children Following a Teaching Unit in Atomic Energy Ed.D., 1953, University of Illinois. 138 pp. Library, University of Illinois, Urbana.

Problem or Problems.--To test the hypothesis that certain parental knowledges, opinions, and interests would result from an instructional unit taught to high school children. The study sought specifically to determine if any measurable changes in understandings, attitudes, and interests in the parents would accompany comparable changes in their high school children.

Steps or Methods.--The study was an experimental-control type. One high school served as an experimental school; the other as a control. 273 students were used in both schools. (1) All the parents of both groups were pre-tested on an atomic energy questionnaire. (2) All the students involved in the study were given the same test. (3) A two-week unit on atomic energy was taught in the experimental school. (4) All the students were given a final test covering the same item. (5) The parents of both groups were given a post test, also using the same items.

Sources of Data.--Reference books, periodicals, experimental groups, control groups, interviews, and questionnaires.

Statistical Treatment.--Chi square, Fisher's "t," coefficient of correlation, mean, and standard deviation.

Major Findings.--(1) Significant differences were found that would seem to indicate that substantial parent education had been achieved through the indirect method provided for in this study. (2) The parents of the experimental group acquired a measure of new facts and understandings, changed a few of their opinions, and altered some of their appraisals in the area of this investigation. Their gains in these items were significantly greater than those of the

control group of parents. (3) Twenty-one factors were isolated to see if they showed any significant differences. None of these did. Such items as intelligence rating, scholastic ability, and religious affiliation were a few of the items tested. (4) Data from the files (subjective judgment) showed that the highest quartile of parents in gains made were much "closer" to their children than were the remaining three-quarters.

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LUCOW, WILLIAM HARRISON. The Use of Analysis of Variance in Estimating the Components of Variation in an Experimental Study of Learning: Textbook-Centered vs. Laboratory-Centered Approach in the Teaching of Introductory High School Chemistry. Ph.D., 1953, University of Minnesota. 232 pp. Library, University of Minnesota, Minneapolis.

Problem or Problems.--To determine the effect of two different methods of instruction upon individual differences.

Steps or Methods.--Two independent parallel experiments were run, the one involving an accelerated course for college preparatory students, the other, non-accelerated and students not preparing to enter college. Analysis of variance was used to interpret the data.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Analysis of variance and covariance.

Major Findings.--With accelerated pupils, the textbook-centered approach and the laboratory-centered approach both produced statistically significant increase in variation. However, the laboratory-centered approach produced greater variation. With non-accelerated pupils, the laboratory-centered approach was superior to the textbook-centered approach in producing a statistically significant increase in variation. Both methods produced significant changes in mean achievements. The techniques of component analysis were demonstrated and confidence intervals were set up for various components of variation.

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MARSH, MARJORY B. Content Analysis of Selected Elementary Science Courses of Study Compared with Content Recommended by Some Selected Expert Teachers of Elementary Science. M.A., 1953, Ball State Teachers College. 40 pp. Library, Ball State Teachers College, Muncie, Indiana.

Problem or Problems.--How does the content of selected courses of study compare with the contents which experts prefer in an elementary science program?

Steps or Methods.--The content of nineteen courses of study, placed in use since 1945, was compared with the contents desired by 35 elementary science teachers considered expert in science. A checklist prepared by the investigator served as an instrument for obtaining information relative to the content in science desired by elementary

Sources of Data.--Courses of study and expert judgments.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--Teachers considered as experts in elementary science preferred the following: (1) Curriculum Guide in Elementary Science to Course of Study as a title; (2) a vertical column organization on paper 8½" by 11" and bound at the left; (3) a general section of the course of study containing a list of scientific attitudes, a list of possible sources of materials, a list of objectives, well developed resource units, suggestions for the use of free, and inexpensive materials, and a general bibliography; (4) some kind of units: learning or resource; (5) a list of visual aids, and (6) units on electricity, living things, weather and climate, simple machines, animals, birds, magnetism, insets, sound, and light.

The teachers regarded the ten most essential units of the elementary science program to include: electricity, living things, weather and climate, astronomy, simple machines, plants, animals, magnetism, conservation, and health.

Courses of study in elementary science placed in use since 1945 agree rather well especially in subject matter, with the preference of teachers considered expert in the field of science. The greatest disagreement is in the general contents of the courses of study and the format.

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McGAY, CULBERT, JR. Developing an Orientation for the General Education Teacher with a Special Competence in Science. Ed.D., 1953, Columbia University. 139 pp. Author, 352 Meadowbrook Avenue, Eatontown, New Jersey.

Problem or Problems.--(1) To develop a useful pattern of educational theory for the general education teacher who possesses a special competence in the sciences. (2) To discover new types of educational experiences which are better suited to present day needs than the experiences commonly found in college science classes.

Steps or Methods.--(1) Study of the factors which have brought about the demand for "General Education," and discussion of each, grouped under the general headings (a) sociological factors, (b) philosophical factors, and (c) psychological factors. (2) Review of the literature describing many of the new science-related courses which have been developed.

Sources of Data.--Courses of study, reference books, periodicals, expert judgments, and textbooks.

Statistical Treatment.--None.

Major Findings.--A study of the developmental tasks of young people, the present needs of society, and the facts of educational psychology, suggests the need for new kinds of educational experiences in college

science classes. A few of these new kinds of experiences can be discovered in some of the science classes designed for general education.

Twelve general education science courses are analyzed to discover the kinds of experience which students have in these classes. Those educational experiences which seem best suited to helping young people in our society with their developmental tasks are suggested as appropriate for use by the general education teacher.

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Mc'HIRTER, NOLAN. The Status of General Biology in the General Education Program of Colleges and Universities in Arizona, Colorado, Kansas, Nebraska, New Mexico, Oklahoma, and Texas. M.A., 1953, Colorado State College of Education. 95 pp. Library, Colorado State College of Education, Greeley.

Problem or Problems.--To establish the status in course content and methods in general biology in the general education programs of colleges and universities in seven Southwestern States.

Steps or Methods.--The data for this study were obtained by use of a questionnaire. A letter was sent to the director of admissions of each of the 119 institutions found in the seven Southwestern States asking the participation of that institution and explaining briefly the purpose of the study. A postcard was enclosed for convenience in replying. Those institutions agreeing to take part in the study were sent a two-page short-answer type of questionnaire containing 23 questions.

A total of 70 institutions or 58.82 percent of the four-year institutions in the seven States agreed to take part in the study. A number declined because general biology was not included in the curriculum of their schools.

All four-year institutions were included. No effort was made to segregate on basis of enrollment, teachers college or liberal arts, white or colored in order to give an overall picture of the status of general biology in the Southwest.

Sources of Data.--Questionnaire.

Statistical Treatment.--None reported.

Major Findings.--General biology is a part of the general education program in 84.69 percent of the institutions represented in this study. A number of institutions not represented in the study are planning to add general education programs and general biology as a part of that program in the near future.

Sixty-two of the sixty-four institutions list general biology as either a definite requirement or a strongly recommended course for all non-science majors. In a few cases botany or zoology may be substituted for biology.

General biology is offered as a freshman course in most institutions with some placing it during the first two years.

Laboratory is a part of the general biology course in 80.64 percent of the institutions responding to the questionnaire.

The general biology course is a one-semester course for four credit hours (semester hours) in the majority of the institutions, and 82.85 percent of the instructors in the institutions represented by this study were men,--41.42 percent hold the rank of professor or its equivalent. Assistant professors and instructors each make up 20 percent of the total and associate professors 17.14 percent.

Eighteen different texts were used in the 53 institutions listing their texts. No one text could be listed as being the one used by a majority of the institutions. Twenty-eight different scientific publications were listed as valuable for additional student reading.

Both science and non-science instructors felt general biology fitted the student need in the general education program better than did a more specialized science. The method of teaching would vary with the instructor, the students and the institutional needs.

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MILLER, CLARENCE ECKMAN. Utilization of Photography to Enrich and Motivate the Biology Curriculum of Lewis and Clark High School. M.Ed. 1953. University of Washington, Seattle.

No review provided.

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NELSON, VERNON RONALD. The Design and Construction of the Audio-Viewer. Ed.D., 1953, University of Colorado. 23 pp. Library, University of Colorado, Boulder.

Problem or Problems.--To design and construct an electronic audio-visual device which would give to the music student direct, purposeful experience in the development and perfection of pitch, volume, and quality control.

Steps or Methods.--(1) Design of instrument. (2) Construction of instrument. (3) Testing of instrument.

Sources of Data.--Reference books, periodicals, and textbooks.

Statistical Treatment.--None.

Major Findings:--In addition to its uses in the study of the pitch, volume, and quality of musical sounds, the audio-viewer will show the effects of posture, relaxation, controlled breathing, vibrato, and embouchure. It may be used as a tuning device, permitting mass tuning, or to demonstrate such musical and physical phenomena as beats harmonic analysis, tone synthesis, and resonance.

NEWSOM, CARL RAY. General Education Science in Methodist-Related Junior and Senior Colleges. Ph.D., 1953, George Peabody College, Library, George Peabody College for Teachers, Nashville, Tennessee.

Problem or Problems.--To determine the present status, content and objectives, procedures of instruction, and the amount of religion and philosophy in general education science courses in Methodist-related junior and senior colleges.

Steps or Methods.--(1) Search of literature. (2) Study of college catalogs. (3) Questionnaires. (4) Study of textbooks. (5) Personal correspondence. (6) School visitation.

Sources of Data.--Textbooks, courses of study, interviews, and questionnaires.

Statistical Treatment.--Coefficient of correlation and comparison of frequencies.

Major Findings.--Most schools offer general education courses. Of the courses recommended for non-science majors, 47 percent were one year in length and 36 percent were one semester in length. Classes were usually very large (45 students). Courses consisted primarily of physics. Thirty-eight percent of instructors had Ph.D. Few were employed to teach only general education school courses.

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OXENDINE, HERBERT GRANTHAN, and READ, JOHN GAMMON. The Grade Placement of the Physical Science Principle "Sound is Produced by Vibrating Material" in Relation to Mental Ages. Ed.D., 1953, Boston University. 124 pp. Library, Boston University, Boston, Massachusetts.

Problem or Problems.--The investigator, using a classroom demonstration technique, took the principle, "Sound is produced by vibrating material," and endeavored to discover at which grade level in relation to mental age the teacher may expect to get maximum learning.

Steps or Methods.--(1) Secured administrative permission to conduct study in schools selected. (2) Briefed the teachers on how they might assist in the testing procedure. (3) Administered a pre-test to the total population on the principle of sound. (4) the fourth and sixth grades each were divided equally into two groups randomly. (5) One half of the fourth grade was placed with one half of the sixth grade forming a group called the experimental group. (6) The remaining fourth and sixth grade pupils were placed in a group called the control group. (7) The experimental group witnessed the lecture-demonstration on the principle, while the control group engaged in a period of silent reading. (8) Both groups took a post-test, (9) The total population was given the Otis Quick Scoring Mental Ability Test Form Beta to establish their mental age. (10) Within a period of three to four weeks a retest, identical to the post-test was given to test retention in the experimental group, and to test any increase or decrease in knowledge of the principle in the control group.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, Fisher's "t", analysis of variance and covariance, and item analysis to establish item difficulty for total test items.

Major Findings.--Statistical analysis of the data indicates that the mental age level of 11-12 years is that point where the pupils attain mastery of the test. Concerning grade placement of the principle, the data indicate that the pupils of the fourth grade are not ready for this instruction. It is possible that in an urban fringe area the fifth grade pupils may be ready for this principle. At the sixth grade level, 57 percent of the pupils, after having seen the lecture-demonstration on the principle of sound, mastered the test. This indicates that these pupils are ready for the instruction.

During the time lapse between the post-test and the re-test, it was found that there was a significant increase in knowledge concerning the principle of sound. This is probably due to the pooling of experiences among the pupils, practice effect of the test or information concerning the principle during the time-lapse. Therefore, the investigator feels that the retention of knowledge is good when the lecture-demonstration method is used in teaching science by principles.

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PEDLOW, MARGARET ELEANOR. Techniques and Suggestions for Kodachrome Slide Sequences That Can Be Prepared by the High-School Biology Teacher. Ed.M., 1953, Cornell University. 49 pp. Library, Cornell University, Ithaca, New York.

Problem or Problems.--To prepare suggestions on the use of Kodachrome slides in the study of biology.

Steps or Methods.--The writer included in this paper the various techniques used in the field and the techniques that have been suggested by other nature and scientific photographers.

Sources of Data.--References and interviews.

Statistical Treatment.--None.

Major Findings.--Sequences of Kodachrome slides were presented that were helpful in the teaching of biology. It was concluded that the material, if used properly in connection with laboratory work, field trips, or class excursions, can be very useful in supplementing the biology instruction.

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PERHACH, ANDREW GEORGE. Materials and Equipment for Elementary School Science. M.S., 1953, Illinois State Normal University. 55 pp. Library, Illinois State Normal University, Normal.

Problem or Problems.--To develop a list of science equipment and materials useful to school administrators, supervisors, and teachers in the development and maintenance of a basic continuous elementary science program.

Steps or Methods.--(1) Recent literature related to problem was reviewed. (2) A specific list of science equipment and material was prepared based on each of eight widely used science textbook series and teacher's manuals published from 1940 to 1952. (3) A composite preferred list of items based on occurrence in four or more series, and also on two levels, namely grades 1 to 6 and grades 7 and 8 was prepared. (4) The findings of this study were compared to similar studies and recommendations for their use were given.

Sources of Data.--Reference books, periodicals, textbooks, and courses of study.

Statistical Treatment.--None.

Major Findings.--The specific list of science equipment and materials for each of 8 science series as well as the composite list of science equipment and materials for all 8 was developed. It can be used as a check list in any school system attempting to work up an adequate supply of equipment and materials.

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PREWITT, CHARLES WALKER. Relationships of Science and Democracy to Education. Ed.D., 1953, Columbia University. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--What type of educational program will aid people in becoming more democratic-scientific citizens?

Steps or Methods.--From reference books and periodicals, from consultations with faculty members, and from personal experience, there were proposed five criteria which described for the study the institutions of science and democracy. These criteria were compared combined, and used as a basis for an educational philosophy and methodology in science education.

Sources of Data.--Reference books and periodicals.

Statistical Treatment.--None.

Major Findings.--It was concluded that the criteria, which for the study described the institutions of science and democracy, were fundamentally complementary and supplementary. Further, these criteria could be and were combined and used as a basis for an educational philosophy and methodology of science education.

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PYLE, JEAN GILMORE. Materials on Fish and Fisheries Management Published by the United States Government and the States -- With Annotations and Discussions of Suitability for Use by Persons

Without Technical Training and for Use in Children's Camping Programs. M.A., 1953, Cornell University. 104 pp. Library, Cornell University Ithaca, New York.

Problem or Problems.--(1) To list available free or low cost materials on fish, fisheries, farm ponds, and fish management. (2) To discuss the material in terms of its usability by the layman and in a camp program.

Steps or Methods.--A survey of Conservation and Extension Departments was made by a questionnaire on a double-fold postcard. Reference materials were studied. Analyses were made to secure suitable materials.

Sources of Data.--Reference books, periodicals, and questionnaires.

Statistical Treatment.--None.

Major Findings.--The conservation of fish is a job in which everyone can take part. It is possible to read about fish, study about them, take a guided field trip and do many other things to understand and to help in management and conservation practices. Many persons including children can help make our streams, lakes, ponds better for fish and for the recreation of fishing. There are a very large number of publications that can be of assistance in programs of this type.

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RAY, SISTER M. AMADEUS. Nationwide Status of the Integrated Course in Physical Science. Ed.M., 1953, Boston University. 34 pp. Librar Boston University, Boston, Massachusetts.

Problem or Problems.--The purpose of this study is to present an accurate account of the status of the integrated course in physical science in senior high schools throughout the United States.

Steps or Methods.--Teachers of physical science from 40 schools in cities with a population of 5,000 and over contributed information. A preliminary request of every State department of education in the United States for names of cities known to teach this subject yielded results from 24 States. Questionnaires were sent to schools suggested by the Departments. These data were tabulated and analyzed.

Sources of Data.--Questionnaires.

Statistical Treatment.--Comparison of frequencies.

Major Findings.--One hundred secondary schools were contacted and seventy responded: forty offered the courses and thirty were not offering it. The names of the schools were listed; the numbers of pupils taking the subject are given; the total school membership is given. Titles, time allotted, grade level:occurrence, number and lengths of laboratory periods, and registration of students in other

previous or concurrent science courses are given. Topics covered by the courses are analyzed. A list of all the textbooks used is included.

There seems to be a definite increase in the number of physical science courses offered; more pupils are taking the course. In some places it is not always a substitute for traditional courses in upper level science, although it is usually the non-college preparatory student who is enrolled.

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SACHS, MORRIS NELSON. A Program of Requirements and An Instrument for Appraisal of Science Facilities in Elementary and Junior High Schools in New York City. Ed.D., 1953, Columbia University. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--To formulate a justifiable program for providing needed science facilities for science education in the elementary and junior high schools in a Manhattan area in the vicinity of Columbia University.

Steps or Methods.--(1) Estimated future elementary and junior high school enrollment trends. (2) Appraised community and neighborhood characteristics, including housing, socio-civic, recreational, cultural, and related factors. (3) Determined the nature of extent of facilities for science education in the existing school plant. (4) Developed a check list and rating scale to evaluate the adequacy and suitability of science facilities in the existing school plant. (5) Applied these standards to determine the condition of science facilities in the existing school plant, the need for modernization, replacement, new construction. (6) Formulated a policy for priority with reference to needed facilities for an effective program for science education. (7) Developed a program of requirements to meet the needs of the present and estimated future enrollment for a well-rounded science program. (8) Indicated the application of this survey method to determine present and future needs in science education in other geographic areas.

Sources of Data.--Inspections, interviews, expert judgments, questionnaires, reference books, periodicals, textbooks, and courses of study.

Statistical Treatment.--None.

Major Findings.--(1) The majority of schools in the pilot study were inadequately equipped for a program in science education. (2) An instrument for evaluation was prepared which may be applied to the total elementary and junior high school plant.

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SCHROETER, ELIZABETH ARLENE. Earth Science in the Secondary Schools. D.Ped., 1953, University of Toronto. 436 pp. Library, University of Toronto, Toronto, Ontario, Canada.

Problem or Problems.--(1) What concepts and topics of earth science are important enough to be included in the secondary school science program? (2) What materials for the development of earth science concepts and topics are available to science students of the secondary schools? (3) What should be the earth science program of the secondary schools?

Steps or Methods.--(1) Topics and concepts of 30 sources were evaluated by 127 science teachers, school administrators, and scientist from all parts of the U.S.A. and Canada. This resulted in 10 topic and 57 concepts of importance for secondary schools. (2) Courses c study and textbooks of 164 representative California secondary schools were analyzed for the evaluated topics and concepts. (3) Earth science problems in the above 30 sources were evaluated by three science men. Topics, concepts, and problems were embodied ir a framework for an earth science course of study for secondary schools.

Sources of Data.--Reference books, periodicals, textbooks, courses of study, expert judgments, and questionnaires.

Statistical Treatment.--Mean, standard deviation, coefficient of correlation, critical ratio, and comparison of frequencies.

Major Findings.--There are many earth science concepts suitable for inclusion in the secondary school program. There is considerable variation in the extent of the earth science program in the secondary schools of California. The earth science program of the California secondary schools is concentrated in the junior high school grades. Sixty percent of the California science textbooks contain some earth science material. Ten topics, 57 concepts, and 908 problems rated important for secondary schools were embodied in an earth science framework developed as a part of this study.

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SILVAN, JAMES C. The Problem Approach in Science Education. Ed.D. 1953, Columbia University. 134 pp. Library, Teachers College, Columbia University, New York, New York.

Problem or Problems.--To show the advantages of the problem approac and to suggest methods of locating problems which can be used in a general education course in college biology.

Steps or Methods.--(1) Examination of general education philosophy. (2) Examination and statement of an approach to subject matter selection. (3) Presentation of illustrative materials from entomology.

Sources of Data.--Reference books, periodicals, courses of study, Government reports, commercial advertising, personal correspondence and interviews.

Statistical Treatment.--None

Major Findings.--It is possible to present fundamental and major areas in biology through the problem approach. It is recommended that (1) an analysis of problem areas be made by the instructor and/or class and (2) student's questions be used in locating and defining problems.

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SIMON, HARRY ARNOLD. A Basic Philosophy of Science Education and Its Application in Biology Teaching. Ed.M., 1953, Cornell University. 87 pp. Library, Cornell University, Ithaca, N.Y.

Problem or Problems.--To study the relationships of a basic philosophy of science education to science instruction in the classroom.

Steps or Methods.--Survey of the literature in the area and a questionnaire sent to 100 biology teachers in the State of New York.

Sources of Data.--Questionnaires.

Statistical Treatment.--Percentage.

Major Findings.--(1) Teachers having smaller classes, teaching in rural schools, and having fewer years of teaching experience tended to use more conservative methods of teaching. These same teachers, however, tended to stress the more progressive concepts. (2) There seemed to be no relationship between the use of progressive methods and the stressing of progressive concepts. However, there was a relationship between progressive concepts and evaluation of methods. Those teachers who stressed the more progressive concepts tended to evaluate progressive methods as effective and conservative methods as not effective.

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SUMMERER, KENNETH H. An Investigation of the New York Regents Examinations in Physics for January 25, 1949, and June 21, 1949. M.A., 1953, University of Michigan. 310 pp. Library, University of Michigan, Ann Arbor.

Problem or Problems.--To item analyze and evaluate 1,682 completed and graded Regents Examinations of the University of the State of New York prepared for physics for January 25, 1949, and 2,142 prepared for physics for June 21, 1949.

Steps or Methods.--The Regents Examinations are divided into two parts. Part I is made up of 50 objective-type questions. Part II is also made up of 50 points but essay-type questions were used. The number of right answers obtained by the students on the odd questions of Part I were compared with the even scores on Part I to obtain the coefficient of reliability. The total score obtained on Part I was compared with the score obtained on Part II to obtain reliability of the whole test and was termed coefficient of consistency. The validity of the examinations was determined by comparing the scores made

by students on the entire test with those made on certain sections of the test which were considered to measure the major objectives of science education.

Sources of Data:--Examinations.

Statistical Treatment.--Coefficient of Correlation.

Major Findings.--The data failed to show that the Regents Examinations in physics for the dates listed are reliable, consistent, or valid.

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TAPPE, DOROTHY. Junior Museums with Special Reference to Bridgeport Connecticut's Wonder Workshop Junior Museum. M.S., 1953, Cornell University. 40 pp. Library, Cornell University, Ithaca, New York.

Problem or Problems.--To present the purposes and operation of junio museums with suggestions for their future development.

Steps or Methods.--Search of the literature in the field and a careful study of Wonder Workshop Junior Museum in Bridgeport, Connecticu

Sources of Data.--Interviews.

Statistical Treatment.--None.

Major Findings.--Junior Museums are highly specialized, but they can provide an exceptional educational opportunity for children during the child's leisure hours.

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TELFER, RICHARD GREENWELL. An Investigation of the New York State Regents Examinations in Physics for June 20, 1950. M.A., 1953, University of Michigan. 174 pp. Library, University of Michigan, Ann Arbor.

Problem or Problems.--To item analyze and evaluate 2035 completed and graded Regents Examinations of the University of the State of New York in Physics. These examinations were prepared for June 20, 1950.

Steps or Methods.--(1) Tallying the scores on the physics examinatio (2) Summarizing the results of the tallies. (3) A determination of the reliability of the examinations. (4) A determination of the validity of the examinations. (5) A check of the areas in the sylla bus with which the examination deals. (6) An item analysis of the examinations. (7) An analysis of the scoring problems. (8) Summary conclusions, and recommendations.

Sources of Data.--Actual examinations.

Statistical Treatment.--Standard deviation, coefficient of correlation, and Chi square.

Major Findings.--The data in the computations fail to show that the Regents Examinations in Physics for June 20, 1950 are reliable, consistent, or valid, to a high degree. It is generally suggested that the examinations be retained and modified; also that a study be made to improve reliability and validity. A scoring key would be most valuable if provided.

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VINING, HUBERT MAYO. A Survey of the Opportunities For Outdoor Teaching to Enrich the Study of Biology for Junior and Senior High School Students at the Viewpoint School, Amenia, New York. Ed.M., 1953, Cornell University. 51 pp. Library, Cornell University, Ithaca, New York.

Problem or Problems.--To present some of the opportunities for the study of biology in the natural settings near Viewpoint School, Amenia, New York.

Steps or Methods.--Field survey of school property and nearby areas.

Sources of Data.--Courses of study and field study.

Statistical Treatment.--None.

Major Findings.--The outdoor experiences suggested for enriching the study of biology emphasized the study of lower forms of plant life, wild flowers, trees, shrubs, birds, mammals, and insects. The proposed field trips were classified as to the season beginning with the fall and progressing to the spring. A Nature Club is recommended.

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WHITE, CHESTER RAYMOND. A Study of Approach-Avoidance Behavior in Relation to Scholastic Accomplishment in Natural Science Study. Ed.D., 1953, University of Pittsburgh. Library, University of Pittsburgh, Pittsburgh, Pennsylvania.

Problem or Problems.--What is the association between the student's evaluation of science as a subject of study and his accomplishment after study?

Steps or Methods.--Measures of accomplishment in science study, general mental ability, and the student's evaluation of science as an academic study were secured. The measures were studied statistically in inter- and multiple-correlation and factoral procedures.

Sources of Data.--Experimental groups, questionnaires, and standard tests.

Statistical Treatment.--Mean, median, standard deviation, coefficient of correlation, critical ratio, Chi square, comparison of frequencies and analysis of variance and covariance.

Major Findings.--Evaluation of science as a study is a factor that is related to accomplishment and operates in conjunction with mental ability both positively and negatively. On the same levels of mental ability, relative evaluation of science as a subject of study appears to influence accomplishment accordingly. On the same levels of science evaluation accomplishment varies with the levels of mental ability. This indicates that mental ability is a limiting factor and science-value a delimiting factor in accomplishment.

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WHITEHEAD, OREN WENDELL. An Investigation of Selected Factors Related to the Professional Status of the Science Teachers in the Four-Year Accredited High Schools of Texas for the School Year 1952-53. M.S., 1953, North Texas State College. 90 pp. Library, North Texas State College, Denton.

Problem or Problems.--(1) What is the background of the science teachers with respect to academic and professional training? (2) What degrees do the science teachers hold and what is the relationship of the degree held to the training received? (3) What kind of certification does the science teacher have? (4) What is the status of the science teachers with respect to the subject matter preparation and the courses taught in the school year 1952-53? (5) What is the official position of the teachers with respect to assignments for the school year 1952-53? (6) What is the status of the science teachers with respect to experience and tenure in teaching science? (7) What is the status of the science teachers with respect to membership in professional or learned societies? (8) What are the trends and tendencies with respect to the status of the science teachers? (9) How does the status of the high school science teachers of Texas compare with the status of high school science teachers in other States and the nation as a whole?

Steps or Methods.--The data concerning student enrollment in high schools were taken from the 1952-53 Public School Directory of Texas. Data concerning the qualifications of the science teachers in the State were taken from questionnaires submitted to a selected group of teachers in accredited high schools. Additional data were taken from related studies. These data were categorized and analyzed to answer the questions noted in the statement of the problem.

Sources of Data.--Questionnaires and Department of Education Records.

Statistical Treatment.--Mean and range.

Major Findings.--(1) There is a shortage of competent science teacher in Texas. (2) Science training in the smaller high schools is below the standard of that found in the larger high schools. (3) Young women, who become interested in science either in high school or in college, should be encouraged to enter the field of science teaching. (4) School administrators should take whatever measures are available to them to retain the same science teachers within their schools. (5) The responsible agency or agencies should take measures to meet

financial competition. (6) Teachers who seek an advanced degree, should consider the field or fields in which they teach. (7) The present certification requirements do not in any way assure that those who teach science will have had adequate training in science.

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WOODBURN, JOHN HENRY. Encouraging Future Scientists: Available Materials and Services. Non-thesis, 1953, National Science Teachers Association. Future Scientists of America Foundation, 1201 Sixteent. Street, N.W., Washington 6, D. C.

Problem or Problems.--What are the sponsored incentive programs and career guidance materials and services designed to encourage more high school boys and girls to stay in the paths that can lead to engineering and scientific careers?

Steps or Methods.--An inventory form, prepared by selected professional leaders, was distributed to industrial organizations and educational institutions and through notices in trade and professional journals. Sponsors were invited to submit details in programs and materials being made available.

Sources of Data.--Questionnaires.

Statistical Treatment.--None.

Major Findings.--A bibliography of sponsored programs and materials designed to provide information on scientific careers was prepared.

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WOODBURN, JOHN HENRY. Encouraging Future Scientists: The Situation. Non-thesis, 1953, National Science Teachers Association. 18 pp. Future Scientists of America Foundation, 1201 Sixteenth Street, N.W., Washington 6, D.C.

Problem or Problems.--To secure teachers' opinions and experiences with sponsored engineering and scientific career guidance materials and services.

Steps or Methods.--A questionnaire was prepared and distributed to high school science teachers. The 455 usable replies were tabulated and the summary report prepared.

Sources of Data.--Questionnaires.

Statistical Treatment.--None.

Major Findings.--Science teachers did not know about many career guidance materials that were readily available. Teachers welcomed such career guidance materials, services and incentive programs. They were not being informed of the availability of such items. Cooperation with industry does offer science teachers many materials and services that aid in maintaining their own enthusiasm and training, and in arousing student interest in engineering and scientific careers.

An Additional 1952 Study

ANDREWS, TED F. and BREUKELMAN, JOHN. Biology Requirements in the General Education Programs of Some Midwestern Colleges and Universities. Non-thesis, 1952, State Teachers College. 5 pp. Author, State Teachers College, Emporia, Kansas.

Problem or Problems.--To obtain certain information about biology requirements in general education programs -- number of hours credit, year taught, size of classes, laboratory or not, open to biology majors or minors, approach, and emphasis.

Steps or Methods.--Questionnaires were sent to 189 colleges and universities. There were returns from 152.

Sources of Data.--Questionnaires.

Statistical Treatment.--None.

Major Findings.--Biology is more commonly required in teachers colleges than in liberal arts colleges. Usually six or more semester hours are required in liberal arts colleges; five or six in teachers colleges. It is taught mostly to freshmen and sophomores. Separate courses are more common in teachers colleges. Principles approach is predominant. Animals are emphasized more than plants.

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An Additional 1951 Study

CARLOCK, JOHN ROBERT. Elementary Science Experiments - A Method of Planning Procedures. M.S.Ed., 1951, Illinois State Normal University 78 pp. Library, Illinois State Normal University, Normal.

Problem or Problems.--(1) To illustrate the planning of experimental procedures that will be in accord with desirable characteristics. (2) To formulate a plan of writing experimental procedures so as to be of greatest value to classroom teachers.

Steps or Methods.--(1) Air Pollution As a Problem of Major Concern was selected to illustrate the objectives of the study. (2) The literature was searched for information concerning this problem. (3) Specific topics under this general problem were selected in which it seemed an experiment might aid in clarification. (4) An experimental procedure was devised, subjected to trial, results evaluated according to the characteristics proposed and acceptable procedures formulated for use by classroom teachers. (5) The experimental procedures worked out involved a model cottrell electrical precipitator, the effect on plant growth of reduced life intensity, and cloud and fog formation and its relationship to air pollution.

Sources of Data.--Experimental groups and control groups.

Statistical Treatment.--None.

Major Findings.--(1) A method of careful planning of science activities related to air pollution and specific direction for repeating these activities are prepared as resource material for classroom teachers.

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